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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/797,672	03/10/2004	Swaminathan Sivakumar	ITL.1102US (P18724)	4141

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EXAMINER	
GURLEY, LYNNE ANN	

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 11/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/797,672	SIVAKUMAR ET AL.	
	Examiner	Art Unit	
	Lynne A. Gurley	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 September 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,8-22 and 24-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-4, 8, 20-22 and 24-28* is/are allowed.

6)☒ Claim(s) *9-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

LYNNE A. GURLEY
PRIMARY PATENT EXAMINER
TC 2800, AU 2812

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to the amendment filed 9/13/04.

Currently, claims 1-4, 8-22 and 24-28 are pending.

Specification

1. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 9-12, and 15-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Oda et al. (US 2002/0168812, dated 11/14/02).

4. Oda shows the method as claimed in figures 2-22 and corresponding text, as exposing a contact plug fill 9 to an etching solution 15 (prior art) or 11 (CMP solution) and 15 (amide solution), e.g. in figs. 11-22; and determining if the region under the contact plug fill is etched away (figs. 6C, 7, and 20-22; [0170]-[0177]). Oda also shows the method as: forming a conductive material 9 in an aperture in a dielectric layer 7; and applying an etching solution to the conductive material to determine whether the conductive material is defective (figs. 6C, 7

and 20-22; [0170]-[0177]). Oda further shows the method as: forming a contact plug fill 9 in a dielectric layer 7; applying a basic solution (amine, which is relatively basic in contrast to the stronger removing solution [0018]-[0019], [0100]-[0103] and [0168]); and determining whether the region underneath the contact plug fill is etched by the basic solution (figs. 6C, 7 and 20-22; [0170]-[0177]). As further support for a basic solution being used, Oda shows a CMP step wherein the CMP solution 11 enters the seam in the contact plug fill. See Suh et al. (US 2002/0036351, [0035]) or Sukharev et al. (US 5,804,249; column 2, lines 21-35) for prior art knowledge of KOH (basic) being used in the CMP slurry to planarize W plugs. The etching solution is capable of etching a characteristic pattern under the contact plug fill if the contact fill is defective (Fig. 6C and 7). The contact plug fill is exposed to an electrical charge, a voltage inspection, electrical testing, determination of dissipation of surface charge and use of contacts for determination, when the resistance is measured (figs. 20-22 and corresponding text). Comparisons are made [0170]-[0177].

5. Claims 9-11, and 15-19 are rejected under 35 U.S.C. 102(b) as being anticipated by Sugasawara et al. (US 6,103,615, dated 8/15/00).

6. Sugasawara shows the method as claimed and as shown in figures 1-5 and corresponding text, as: exposing a contact plug fill 128/132/136/138 to an etching solution (cleaning solution or solvent); and determining if the region under the contact plug fill is etched away (figs. 2, 5 and corresponding text). Sugasawara also shows the method as: forming a conductive material 128/132/136/138 in an aperture in a dielectric layer (abstract and text); and applying an etching solution (cleaning solution or solvent) to the conductive material to determine whether the

conductive material is defective (figs. 2, 5 and corresponding text). Monitoring features are disclosed using electrical means, voltage means, resistance means, various conventional equipment, using comparisons as well.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oda et al. (US 2002/0168812, dated 11/14/02) in view of Sugasawara et al. (US 6,103,615, dated 8/15/00).

Oda shows the method substantially as claimed, and as described in the preceding paragraphs.

Oda lacks anticipation only in not teaching that: the solution preferably etches along the <111> crystallographic orientation; and the solution etches a V-shaped trench under a defective conductive material.

Sugasawara teaches a similar method where corrosion of W plugs is studied in reference to cleaning and etching solvents and solutions. Methods of corrosion testing using probes, power sources, resistance, etc. are discussed (column 11, lines 35-67; column 12, lines 1-54).

It would have been obvious to one of ordinary skill in the art to have had the solution preferably etch along the <111> crystallographic orientation and to have had the solution etch a V-shaped trench under a defective conductive material, in the method of Oda, with the motivation that depending upon the solution used, and the specific material under the contact plug fill, the combination of the two could be chosen such that the solution would etch along the <111> orientation and a V-shaped trench would result.

It would have been obvious to one of ordinary skill in the art to have used a secondary electron image to determine if the conductive material is defective, in the method of Oda, with the motivation that Sugasawara teaches that many reliable well known method may be used to monitor the corrosion condition, electron image would also be a conventional method (column 12, lines 32-53).

Response to Arguments

11. The examiner agrees with the amendments to claims 1-8, 20-22 and 24-28. Therefore, the rejections relating to these claims have been withdrawn. However, Applicant's arguments filed 9/13/04, regarding claims 9-19, have been fully considered but, they are not persuasive. In response to Applicant's remarks, page 5, in Oda, specifically, the comparative examples [0170]-[0177] show that the lower wiring layer is deteriorated, after it is exposed to the basic removing solution, through the seam in the metal plug material. These comparative examples are intentionally performed, in order to learn the extent of the plug deterioration. They are not the result of normal processing steps. Therefore, the Examiner believes that the damage is produced intentionally in order to identify the extent of the damage to or the defectiveness of the contact fill.

Allowable Subject Matter

12. Claims 1-4, 8, 20-22 and 24-28 are allowed, subject to an updated search.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. See the PTO 892 for further related art.

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is 571-272-1670. The examiner can normally be reached on M-F 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling can be reached on 571-272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Lynne A. Gurley
Primary Patent Examiner
TC 2800, AU 2812

LAG
November 23, 2004